Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D. C. 20554

In the Matter of:	)	
	)	CC Docket No. 94-102
Revision of the Commission's rules	)	
to ensure compatibility with	)	RM-8143
enhanced 911 emergency calling systems	)	

Reply comments of
Sanders

Sanders offers the attached information which may be of value to the commission in deciding how to proceed in the matter of ensuring wireless compatibility with enhanced 911 emergency calling systems.

Respectfully submitted,

Gregory E. Webb
General Manager
Telecommunications Systems
(603)645-5460

Sanders
Lockheed Martin Corporation
65 Spit Brook Road
Nashua, NH 03061

I. Executive Summary

1. Sanders strongly supports the Commission's objectives of ensuring wireless access to E911 location capability as required by public safety organizations to support emergency and rescue operations. The Commission has stated that the industry should direct particular attention to offering an emergency 911 capability for services that would work with enhanced 911 systems and, to the extent feasible, permit locating a caller when the caller does not know his location. Sanders notes that all parties responding to the Commission's Notice of Proposed Rule Making also support the provision of wireless E911 features.

2. Sanders has extensive experience with wireless location technologies for use in defense related systems and has applied this experience to the wireless E911 problem. Because much of this work has been accomplished on classified government contracts, it has been largely unknown to the cellular community until recently transitioned by Sanders into public safety applications. On February 1, 1995 Sanders announced a new line of products developed to provide location services for cellular phone users[1]. The company has developed equipment for locating wireless telephones, analyzed important cost considerations relative to implementation of the wireless

[1] See Attachment 2 - Lockheed Sanders Press Release

location systems and established a business unit to manufacture and sell such systems for use in cellular E911 and other applications. Our comments are therefore focused on these specific areas of the commissions inquiry.

3. Sanders believes that a system used to provide wireless location information must meet the following criteria:

A. Work with the existing installed base of over 20 million cellular telephones.

B. Provide for maximum compatibility with the existing E911 infrastructure.

C. Provide for tracking the location of moving telephones.

D. Provide the precise location accuracy required in many emergency and rescue operations.

E. Be available now for rapid implementation.

F. Be cost effective and affordable on a system wide basis.

4. The Sanders system for locating cellular phones meets these criteria. The Smart Look system employs network based Time Difference of Arrival (TDOA) location equipment to provide the approximate location in a format useful to call-takers or dispatchers. If the cellular phone is moving, the approximate location is updated as

necessary. Once in the general area, a portable location device can then be used by the dispatched emergency or rescue team to precisely locate the telephone. Pre-production units are currently undergoing final system tests and field measurements in actual operating environments. The equipment will be available in production quantities in 1995.

5. Sanders believes that this system design, combining fixed network based TDOA techniques with a mobile phase differencing device, provides the most reliable and cost effective approach to precision location of cellular telephones.

6. Still, the investment required to implement location capability nationwide on the existing cellular networks is significant and could exceed a billion dollars. Sanders concludes that the investment is nevertheless in the public interest and affordable, given the critical public health and safety requirements and the relatively small percentage increase (2% to 5%) in total cellular revenues which would be needed to produce a reasonable return on the required investment.

7. The Federal Communications Commission has a variety of options at its discretion in adopting rules to expedite wireless compatibility with enhanced 911 systems. Sanders believes that the adoption of a standard funding mechanism to support the required investments is among the most important factors the commission

should consider in deciding how to proceed in this matter. The funding mechanism adopted should be triggered by, or linked to, specific implementation milestones applicable equally to competing carriers.

8. Once the industry sees that reliable technology is available and that a standard funding mechanism is in place for all providers, we believe that the remaining technical implementation problems and standards issues can and will be overcome by a concerted industry effort. Sanders stands ready to participate in this effort and would be willing to lead or participate in industry advisory committees as required to help ensure that the best possible technology is made available to meet the needs of the public safety industry in a timely manner.

II. Sanders strongly supports the Commission's objectives of ensuring wireless access to E911 location capability as required for emergency and rescue operations.

9. The importance of location capability is illustrated by the results of a survey by Public Opinion Strategies of Alexandria, Va., as reported by the CTIA[2]. Safety and security were cited as the main reason for purchasing mobile phones by 62 percent of the users. That's nearly twice the number who said they purchased their phone for business or convenience. Almost half the people surveyed said they had used their phone to report car trouble, medical emergencies, crimes or drunk drivers.

10. A recent article[3] by Clement J. Driscoll of C. J. Driscoll & Associates, reports that some 25% of cellular callers to 911 are unable to identify their location. This situation results in delayed emergency response times, lost rescue opportunities and other serious consequences impacting the public health and safety. Sanders believes there is an urgent need for a system to provide cellular E-911 location capability.

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[2] CTIA Fax Notes, November 1994

[3] RCR, September 19, 1994

III. Sanders has extensive experience with wireless location technologies.

11. Sanders has extensive experience with wireless location technologies for use in defense related systems and has applied this experience to the wireless E911 problem. The company has developed equipment for locating wireless telephones, analyzed important cost considerations relative to implementation of wireless location systems and established a business unit to manufacture and sell such systems for use in cellular E911 and other applications. Our comments are therefore focused on these specific areas of the commissions inquiry.

12. Sanders, an operating company of the Lockheed Martin Corporation, is engaged in the development, manufacture, sale and support of advanced electronic systems. The company serves a broad range of defense and commercial markets through technologies that include wide-band radio, simultaneous multi-band and multi-protocol radio, and very high speed, real time, digital signal processing. Sanders also operates one of the few foundries in the U.S. for custom production of gallium arsenide monolithic microwave chips. Sanders has approximately 4700 employees and is a wholly owned subsidiary of the Lockheed Martin Corporation.

13. Sanders has formed a Telecommunications Systems business unit to focus on the development, manufacture and sale of cellular location equipment and other products for the wireless telecommunications industry.

IV. Sanders believes that the system to provide wireless location information must meet the following criteria.

A. Work with the existing installed base of over 20 million cellular telephones.

14. Sanders believes that the public interest is best served by a location system which does not require modifications to the existing base of cellular hand sets. Sanders has concluded that approaches requiring such modifications do not address the immediate need or provide additional benefits that would justify the delay or costs involved in modifying more than 20 million cellular telephones.

B. Provide for maximum compatibility with the existing E911 infrastructure.

15. Since a wireless telephone location is not necessarily a fixed street address, wireless systems must necessarily deal with location data in a different manner than the current E911 systems for wire line services. Nevertheless, most E911 systems are based on street address or mapping information and the wireless solution must be integrated into an existing system while minimizing the requirement to retrain thousands of call takers, dispatchers and mobile

emergency response personnel. Sanders system incorporates a flexible, user defined interface which can provide location data to a variety of users in any format the user desires.

16. Base station compatibility is also an important consideration. Sanders has selected a system approach which is transparent to all existing base station equipment such that Smart Look I & II are compatible with base station equipment from all major suppliers. No modification to the base station equipment is required, either hardware or software, nor is any interface to the mobile switch needed. Installation time per base station is estimated to be less than 8 hours. Sanders is prepared to support installation and checkout, training of cellular service providers and public safety personnel, and to provide continuing support following activation.

C. Provide for tracking the location of moving telephones.

17. Since the location of a wireless phone being used for a 911 call may change, the system adapted for cellular location must be capable of tracking the location as the call is in progress. In a survey[4] of Public Safety Answering Point

[4] As reported in NENA NEWS, November, 1994 pg 15.

(PSAP) personnel who belong to both National Emergency Number Association (NENA) and Association of Public-Safety Communications Officials-International (APCO), this requirement was cited by a three-fifths majority who requested dynamic, real time reporting for callers who do not stop moving while placing a call to 911.

D. Provide the reliability and precise location accuracy required in many emergency and rescue operations.

18. Sanders has considered a variety of approaches to provide location services on cellular networks. Angle Of Arrival (AOA) systems require the installation of antenna arrays at each measurement site. These arrays are not only costly to install, but can contribute dramatically to the wind load experienced on each tower. The problems associated with Global Positioning System (GPS) technology related to in-building and in city use of hand held wireless units are well documented and result in unreliable location data. TDOA systems provide greater reliability since the location is computed directly from the signals received and the system is not dependent on the ability of the handset to receive satellite signals. Neither AOA, GPS or TDOA can provide the precise location capability needed for apartment complexes, multi-story buildings, etc. Sanders has concluded that neither AOA, GPS or TDOA

approaches alone, can provide sufficiently accurate and reliable Automatic Location Identification (ALI) for use in situations involving public safety emergencies.

19. Sanders has thus adopted a combined technology approach utilizing a refined TDOA technique to reliably provide the approximate wide-area location and a unique, highly accurate phase differencing technique for precise location. The phase differencing part of the system is a small, mobile device. It is extremely accurate at short distances (<1000 meters) and allows the phone to be precisely located in three dimensions to within one meter, even in difficult environments such as apartment complexes and multistory buildings.

E. Be available now for rapid implementation.

20. There are currently about 17,000 cell sites in the US cellular network and hundreds more being added each month to support the rapid growth of wireless telephone service. With each cell site placed into service without cellular location capability, the investment required to retrofit the network increases. As each month passes, the revenue which could have been collected to support wireless E911 is foregone. With each wireless 911 call the opportunity to use the location information to assist a caller in a rescue or

emergency situation is lost forever. Sanders thus feels that continued delays will result is a worsening situation rather than an improving situation.

Sanders pre-production units are currently undergoing final system tests and field measurements in actual operating environments. The equipment will be available in production quantities in 1995. Sanders has production capacity available to support market demand. Sanders also intends to consider custom design, OEM and licensing arrangements as required to meet market requirements.

F. Be cost effective and affordable on a system wide basis.

21. There are many cost considerations affecting the implementation of an ALI requirement for enhanced 911 service for wireless customers. Sanders believes that its two tier system design provides the most cost effective solution at an affordable cost.

22. More specifically, Sanders has concluded that its Smart Look system design, combining network based TDOA techniques with a mobile phase differencing device, is the most cost effective approach to locating cellular telephones. This approach does not require any modifications to the existing base of over 20 million cellular telephones, provides approximate location

information for use by call-takers and dispatchers from an efficient and reliable-network based system, and provides precision location in the form of a low cost mobile device which can be used by emergency and rescue personnel on the scene to locate a telephone -- even in very difficult environments.

23. While the investment required to implement location capability is significant, Sanders has concluded that the investment is nevertheless in the public interest and affordable based on the relatively small percentage increase (2% to 5%) in total cellular revenues which would be needed to produce a reasonable return on the required investment. The price increase will have a negative impact on demand which could be offset by the additional features related to location capability.

24. In addition to providing location information to support wireless E911 requirements, Sanders has identified a number of potential revenue producing services which could be supported by cellular location capability. Our research in this area is continuing, however it appears that such services even if successful after a reasonable market introduction and development period, would not provide the revenue necessary to support the investment during the first few years.

25. Depending on a number of factors, such as the cost tradeoffs made, volume of sales, and service options chosen, the cost for a system could range from perhaps $80,000 to $100,000[5] per cell site equipped. A sufficient number of network sites need to be equipped to provide coverage of each served area from multiple sites so that the desired accuracy can be achieved.

26. Based on statistics published by the Cellular Telephone Industry Association (CTIA) there are currently about 17,000 cell sites in service throughout the US. To equip all cell sites would thus require a total investment in the range of about $1.5 billion to $2.5 billion plus about $400 to $600 million additional per year to handle the growth in cell sites. This includes the network Time Difference Of Arrival (TDOA) equipment and approximately 34,000 mobile or handheld devices but does not include interface equipment or custom engineering which could be required in some cases to meet local PSAP interface requirements.

27. If this deployment were to be funded solely through a surcharge on each subscriber, the required surcharge is estimated to be in the range of $2.50 to $4.00 per month or about 4% - 7%, given an average monthly cellular bill of about $60.00. However, not every cell site will require location equipment

[5] Based on estimated prices as shown in attachment 1

and there is some potential for value added from new services and fraud reduction, we estimate that a funding mechanism equivalent to 2% - 5% would provide a sufficient economic incentive to ensure deployment. The economic considerations are covered in greater detail in the attached cellular location business case[6] which addresses the service provider's perspective.

28. It should also be noted that the Sanders system can be configured to provide sufficient bandwidth and capacity to provide location information for both the A and B service providers in a given service area. This would allow for the possibility of the commission authorizing a third party provider of location services covering the customers of both wireless providers in a service area. A third party provider (or an A + B joint venture company) with access to cell sites from both carriers could potentially provide superior location capability and at the same time use fewer cell sites and require less investment than would be required with each service provider independently covering the same geographic areas.

[6] Attachment 2.

V. The Federal Communications Commission has a variety of options at its discretion in adopting rules to expedite wireless compatibility with enhanced 911 systems.

29. Sanders believes that the adoption of a standard funding mechanism to support the required investments is among the most important factors the commission should consider in deciding how to proceed in this matter.

30. Since implementation of wireless E911 represents a critical public health and safety need, the commission could encourage service providers to add a surcharge to each subscribers bill or, to avoid differences between competitive service providers, the commission could require that a specific surcharge formula be applied by all service providers. The commission could also consider setting aside a portion of the proceeds from frequency spectrum auctions and fees or adapt other funding mechanisms. The funding mechanism adapted should be triggered by or linked to specific implementation milestones applicable equally to competing carriers.

31. Once the industry sees that reliable technology is available and that a standard funding mechanism is in place for all providers, we believe that any

technical implementation problems and standards issues can and will be overcome by a concerted industry effort. Sanders stands ready to participate in this effort and would be willing to lead or participate in industry advisory committees as required to help ensure that the best available technology is made available to meet the needs of the E911 public safety and emergency response entities in a timely manner.

Attachment 1

Estimated Smart Look Pricing

Attachment 1

Smart Look™ System Level Price Estimates

	Estimated Purchase Price *	Finance Lease Option	Installation & Testing Charge
Smart Look™ Core Platform			
Required for each Smart Look™ Site			
Includes Core Computing Platform, VME,			
Network Router and all System Software	$90K	Yes	Yes
Smart Look™ II Standard Portable Precision Units (Plus Shipping)			
1 to 10 additional units (ea.)	$9.5K	Yes	No
11 to 50	$9.0K	Yes	No
More than 50 units	$8.0K	Yes	No
See Micro Look™ Product Information for vehicle mounted, OEM and custom versions of portable unit			
Master Control Center			
Master Control Center	$25K	Yes	Yes
Command and Control Software	$30K	Yes	Yes
Map Display (optional)	$5K	Yes	Yes
Smart Look™ Antenna System (Optional)			
Required for stand-alone Smart Look™ sites	TBD	Yes	Yes
Technical Assistance Center Access (Optional)	TBD	na	na

* Prices do not include custom engineering where required to meet local PSAP requirements.

Attachment 2

Lockheed Sanders Press Release

Communications Office
Lockheed Sanders
65 SPIT BROOK ROAD
NASHUA, NEW HAMPSHIRE 03061-0868

FOR FURTHER INFORMATION CONTACT:

FOR RELEASE:

Joe Wagovich, (603) 885-2816

IMMEDIATE RELEASE

SUMMARY: LOCKHEED SANDERS UNVEILS CELLULAR PHONE LOCATOR PRODUCTS

NEW ORLEANS, La. -- (February 1, 1995) Lockheed Sanders today announced a new line of products developed to provide location services for cellular phone users. The products address the need by cellular carriers and public safety agencies to respond to the growing number of emergency calls placed by wireless telecommunications consumers. They also provide a tool for use in controlling cellular phone fraud, a problem that, according to the Cellular Telecommunications Industry Association, costs carriers $1 million per day.

The first two location products, Smart Look* Wide Area Location System and Micro Look* Precision Location System, employ proven Sanders technologies to address emergency and public service market requirements. The units may be integrated seamlessly into existing carrier infrastructure networks and deliver location capabilities economically.

Lockheed Sanders designed its components and related software and hardware platforms as flexible systems, forming the foundation for a family of wireless applications and services for future development.

Smart Look consists of Remote Units, a Control Unit and intercommunications. The Remote Unit has an open-architecture, industry-standard VME chassis and is compatible with a wide variety of base station equipment in use today. The Control Unit is based on an industry standard workstation. Smart Look is designed to locate a call originated anywhere within a service area to within one city block.

- more -

* TM Lockheed Sanders, Inc.

The companion Micro Look product is a portable unit about the size of a small notepad that can quickly and reliably provide a true line of bearing to a transmitting phone, leading a response team directly to the caller.

Both products employ Sanders technologies, developed for critical defense applications, to address the location issues expressed in public policy statements of the Telecommunications Industry Association and in the initiatives described in the FCC's Notice of Proposed Rule Making, Docket Number 94-102.

Lockheed Sanders, an operating company of the Lockheed Corporation, is engaged in the development, manufacture, sale and support of advanced electronic systems. The company serves a broad range of defense and commercial markets through technologies that include wide-band radio, simultaneous multi-band and multi-protocol radio, and very high speed real time digital signal processing. Lockheed Sanders also operates one of the few foundries in the U.S. for custom production of gallium arsenide monolithic microwave chips.

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Attachment 3

Service Provider

Cellular Location Services

Business Case

Service Provider

Cellular Location Services Business Case

March 1995